

# **HITACHI FLOPPY DISK DRIVE INSTRUCTION MANUAL**

**LORAL**  
**INSTRUMENTATION**  
A SUBSIDIARY OF LORAL CORPORATION

# **HITACHI COMPACT FLOPPY DISK DRIVE MODEL HFD305SX**

**3" SINGLE -SIDED, DOUBLE-DENSITY TYPE**

**INSTRUCTION MANUAL**



# 1. SPECIFICATIONS

## (1) Performance

Table 1 Performance

| Items                                 |                     |            | Type  | Single density<br>(FM) | Double density<br>(MFM) |
|---------------------------------------|---------------------|------------|---|------------------------|-------------------------|
| Capacity                              | Unformatted         |            |   | 125 K bytes            | 250 K bytes             |
|                                       | Formatted           | 16 sectors |   | 81.9 K bytes           | 163.8K bytes            |
|                                       |                     | 9 sectors  |   | 92.2 K bytes           | 184.4K bytes            |
|                                       |                     | 5 sectors  |   | 102.4K bytes           | 204.8K bytes            |
| Transfer rate                         |                     |            | 125K bits/sec   | 250K bits/sec          |                         |
| Recording density (most inside track) |                     |            | 4473 BPI  | 8946 BPI               |                         |
| Encoding method                       |                     |            | FM  | MFM                    |                         |
| Track density                         |                     |            | 100 TPI   |                        |                         |
| Cylinders                             |                     |            | 40  |                        |                         |
| Tracks                                |                     |            | 40/single side, 80/double side                          |                        |                         |
| Media rotational speed                |                     |            | 300 r.p.m.  |                        |                         |
| Average latency time                  |                     |            | 100 msec  |                        |                         |
| Motor start time                      |                     |            | 0.5 sec max   |                        |                         |
| Ready from Motor ON *1                |                     |            | 1 sec max   |                        |                         |
| Access time                           | Average access time |            | 70 msec   |                        |                         |
|                                       | Track to track *2   |            | 3 msec  |                        |                         |
|                                       | Settling time       |            | 30 msec   |                        |                         |
| Data sector Record media              |                     |            | Soft sector 5, 9 or 16                                  |                        |                         |
| Recording media                       |                     |            | 3-in. Compact Floppy Disk<br>(Maxell CF2 or equivalent) |                        |                         |

NOTE: 1. Lapse of time from input of the MOTOR ON signal until output of the READY signal upon sensing that the motor has reached the specified rotational speed.

2. Settling time is not included.

## (2) Power Specifications

Table 2 Power Specifications

| Items                  |             | Power | DC12V             | DC5V             | Wattage |
|------------------------|-------------|-------|-------------------|------------------|---------|
| Tolerance              |             |       | ±5%               | ±5%              |         |
| Ripple noise           |             |       | 100mVp-p or below | 50mVp-p or below |         |
| typ. power consumption | Stand-by *1 |       | 0.06A             | 0.23A            | 1.9W    |
|                        | Read        |       | 0.19A             | 0.29A            | 3.7W    |
|                        | Write       |       | 0.27A             | 0.32A            | 4.8W    |
|                        | Seek        |       | 0.42A             | 0.24A            | 6.2W    |
| Max current            |             |       | 0.60A             | 0.50A            |         |

NOTE: 1. "Stand-by" corresponds to the status that drive select signal is off and motor on signal is off.

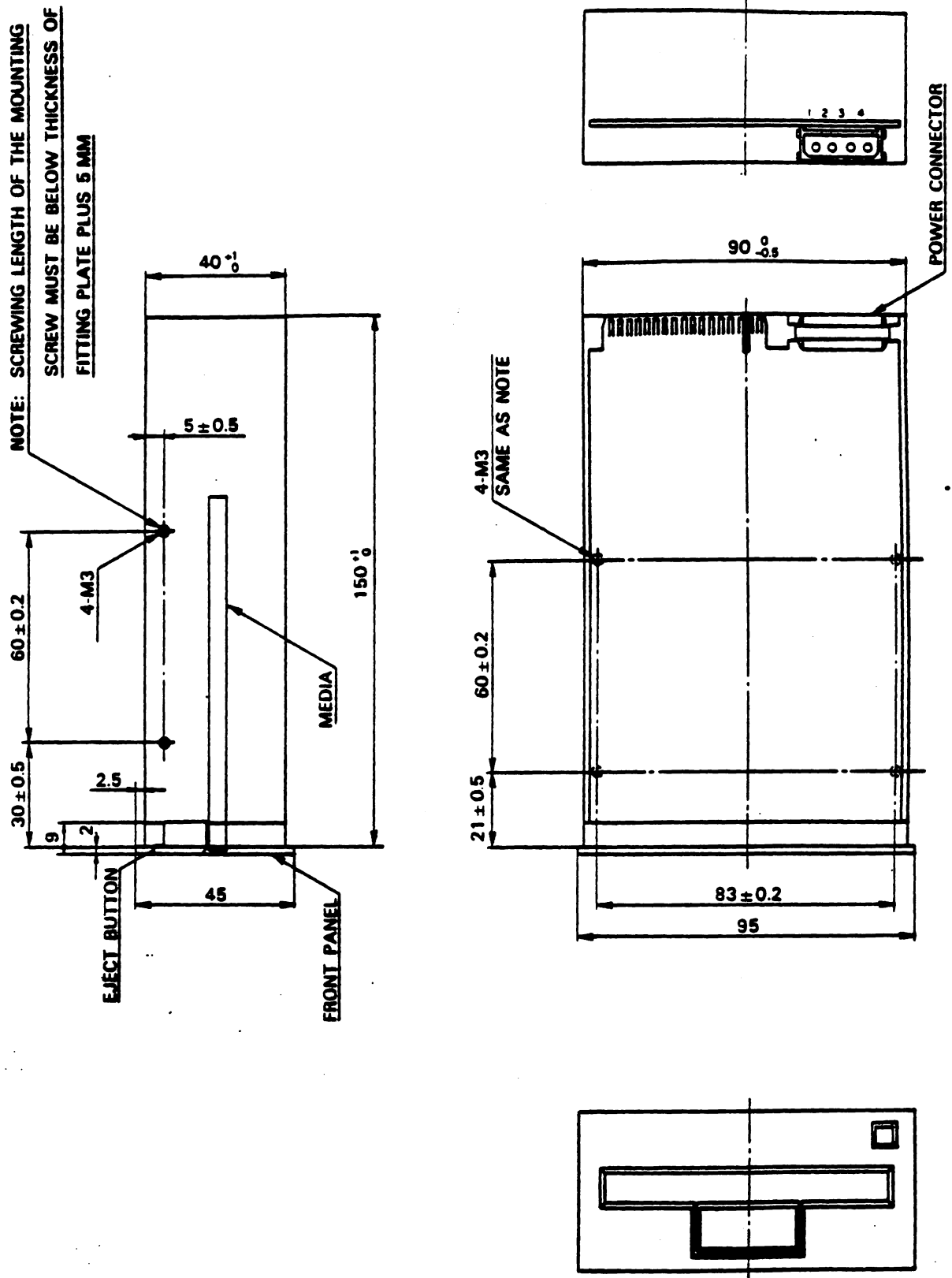


Fig. 1 DIAGRAM OF OUTER DIMENSIONS AND MOUNTING DIMENSIONS (HFD 305 SXA)

## (5) Reliability Specifications

Table 5 Reliability Specifications

| Items       |             | Specifications  |
|-------------|-------------|---|
| MTBF        |             | 8,000 POH (reference value) *1  |
| MTTR        |             | 0.5 Hr  |
| Unit life   |             | Five years or 15,000 POH, whichever is shorter (maintenance parts excluded) |
| Error rates | Soft errors | $10^{-8}$ times/bit *2  |
|             | Hard errors | $10^{-12}$ times/bit  |
|             | Seek errors | $10^{-8}$ times/seek  |

**NOTE:** 1. Running time of the drive motor is set at 25% of POH (POWER ON hours) under normal operating conditions.

2. Include 2 times retry.

## 2. CONFIGURATION

The Compact Floppy Disk Drive (FDD) consists of a mechanical part and a logical part. Fig. 2 is a schematic diagram of its construction.

### (1) Load/Unload Mechanism

Media loading is automatically effected by inserting the cartridge of the Compact Floppy Disk.

In this case, the shutter of the head window is automatically opened so that head loading can also be effected.

By pressing the eject button, the recording media is automatically ejected.

**(2) Drive Mechanism**

The drive mechanism consists of a drive motor, drive pin, and hub retainer.

The drive pin connected to the drive motor fits into the hub drive groove of a recording media for driving the mechanism.

**(3) Positioning Mechanism**

Carriage positioning is effected by a step motor through using a steel belt.

**(4) Index Sensor**

Upon sensing an index hole (small hole) in the recording media, the LED/Photo Transistor combination produces an index pulse.

**(5) Track 00 Sensor**

Upon sensing – according to the carriage position – that the magnetic head is positioned at Track 00, this sensor produces a TRACK 00 signal.

**(6) Write Protect**

The write protect circuit consists of a pair of LED and a photo transistor, and a logic circuit.

Checking is effected by the status of a write inhibit detection hole in the Compact Floppy Disk plastic case; when the hole is not masked, a write inhibit status is established so that data writing is rejected.

**(7) Operation Display LED**

Mounted on the front panel, this operation display LED is designed to notify the user that the drive is in a specific state of operation.

Additional this LED is able to turn ON, by latching the IN USE signal at negative-going edge of drive select signal.

**(8) Drive Motor Control**

This electronic control circuit enables the brushless, direct drive motor to run at a stabilized, fixed speed against load fluctuations.

**(9) Logic PCB**

The control circuit, which consists of a control logic circuit including a Write/Read control circuit, controls the drive in accordance with instructions from a host system.

The Logic PCB contains the following main circuits; a block diagram of the logic circuit is shown in Fig. 3.

- |                                   |                              |
|-----------------------------------|------------------------------|
| a) DRIVE SELECT circuit           | e) TRACK 00 detector circuit |
| b) Stepping motor drive           | f) READY detector circuit    |
| c) INDEX detector circuit         | g) Read circuit              |
| d) WRITE PROTECT detector circuit | h) Write circuit             |

### 3. RECORDING MEDIA

#### (1) Recording Media

The recording media applied to this FDD is made of flexible mylar sheet provided with magnetic material coating and enclosed in a special plastic case as shown in Fig. 4.



#### (2) Operating Method

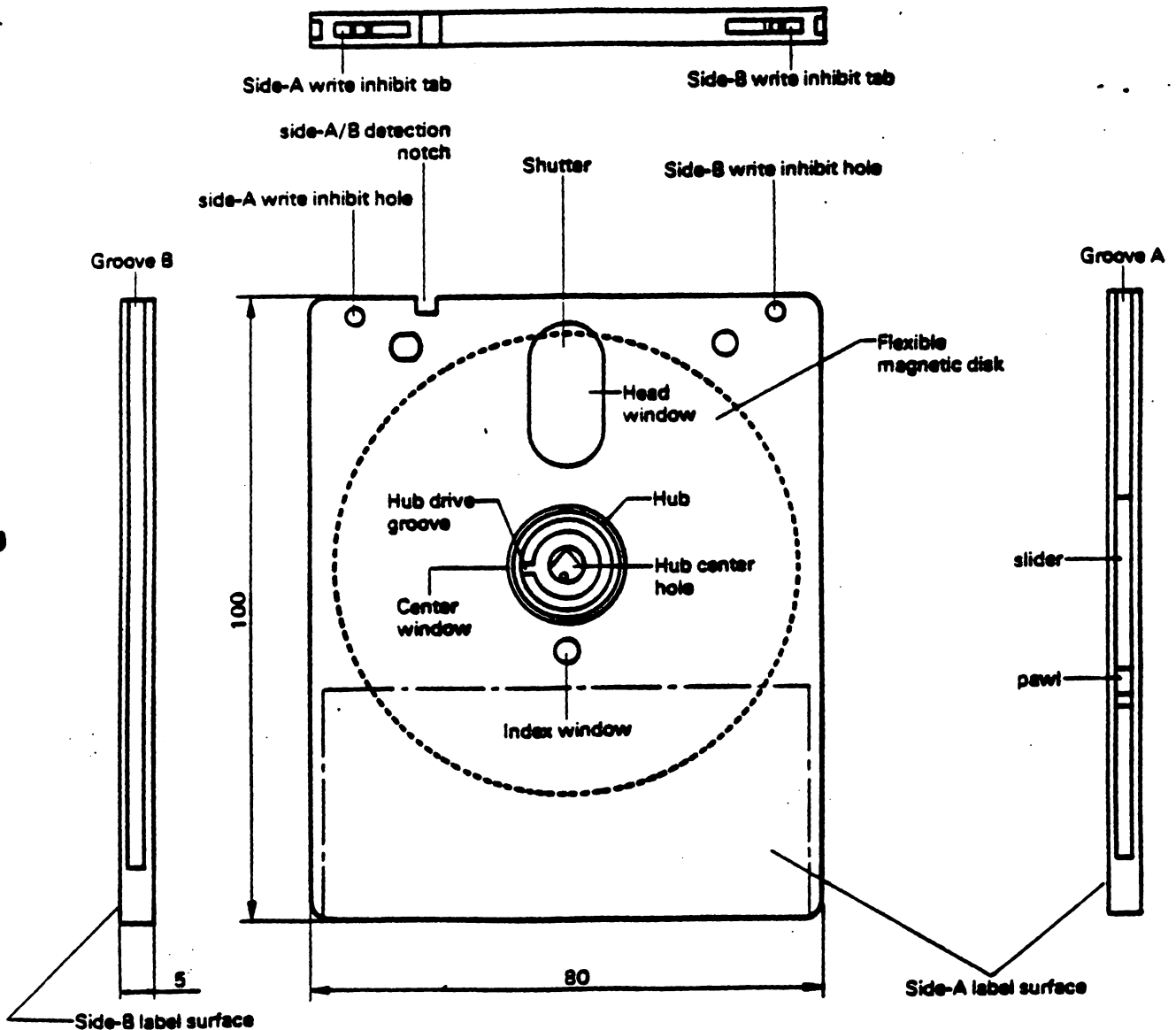


Fig. 4 Recording Media

| INDEX         |           | SECTOR 01 |      |          |     |     |      |      |     |            |        |          |        |     |    | INDEX |      |      |
|---------------|-----------|-----------|------|----------|-----|-----|------|------|-----|------------|--------|----------|--------|-----|----|-------|------|------|
| Last Sector   | Postamble | Preamble  |      | ID field |     |     |      |      |     | Data field |        |          |        |     |    | GAP4  | GAP3 | GAP4 |
|               | GAP4      | GAP1      | SYNC | AM1      | ID  | CRC | GAP2 | SYNC | AM2 | DATA       | CRC    | GAP3     | GAP3   |     |    |       |      |      |
| Record system | FM        | Bytes     | 40   | 6        | 1   | 4   | 2    | 11   | 6   | 1          | 128    | 2        | 27     | 77  |    |       |      |      |
|               |           | HEX       | FF   | 00       | FE* | **  | ...  | FF   | 00  | FB* or F8* | (DATA) | ...      | FF     | FF  |    |       |      |      |
|               | MFM       | Bytes     | 80   | 12       | 3   | 1   | 4    | 2    | 22  | 12         | 3      | 1        | 256    | 2   | 54 | 218   |      |      |
|               |           | HEX       | 4E   | 00       | A1* | FE  | **   | ...  | 4E  | 00         | A1*    | FB or F8 | (DATA) | ... | 4E | 4E    |      |      |

\* Indicates the presence of missing clock.

\*\* Indicates ID field.

... Indicates CRC check character.

Fig. 5 Example of Data Format (16 sectors)

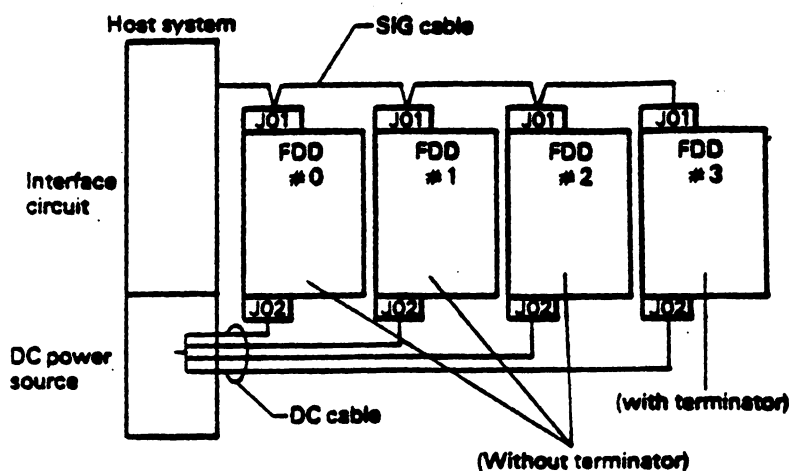


**(2) Cable and connector**

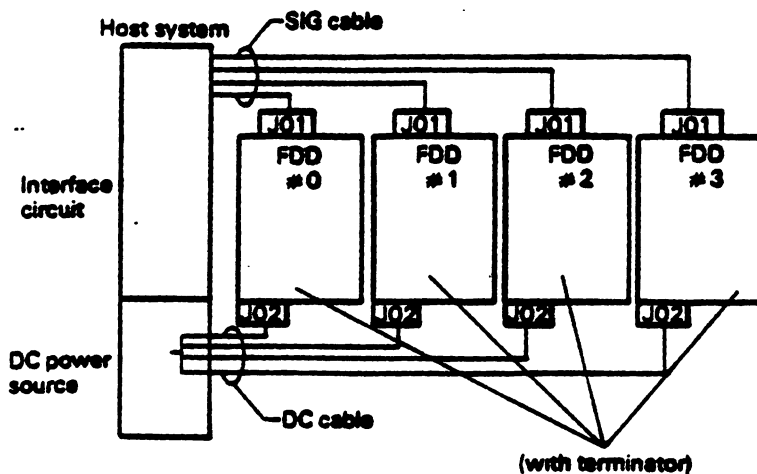
The HFD 305SX employs two types of cable - a cable for signal (SIG cable) and a power supply cable (DC cable). The SIG cable is connected to connector J01; the DC cable is connected to J02 - both on the drive side.

When the HFD 305SX is directly mounted on the grounded frame of a host system, usually no ground cable needs to be installed.

Fig. 8 shows the mounting position of each connector; Fig. 9 is the connector pin arrangement; Fig. 10 is the interface connection.



**Fig. 6 Daisy Chain Connection**



**Fig. 7 Radial Chain Connection**

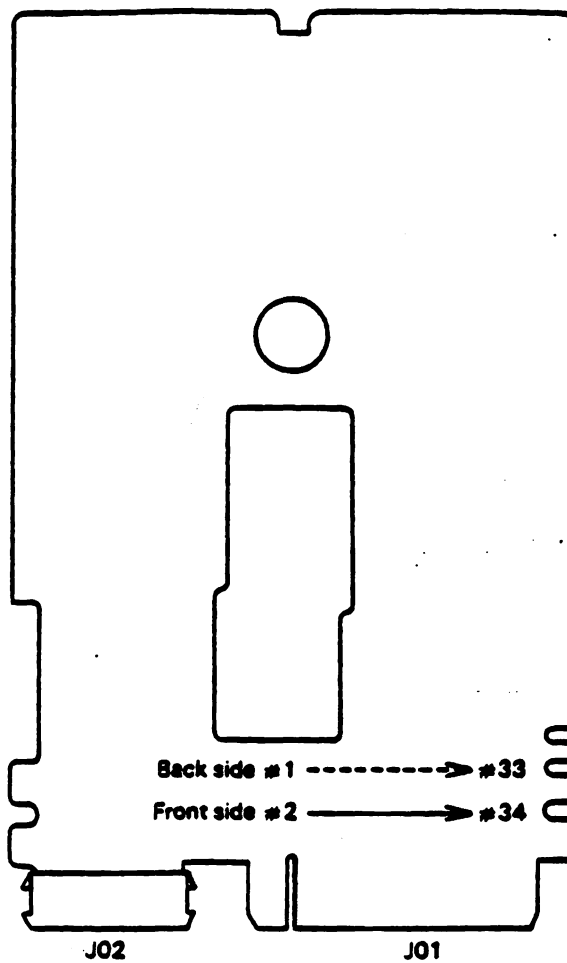


Fig. 8 Connector Mounting Position

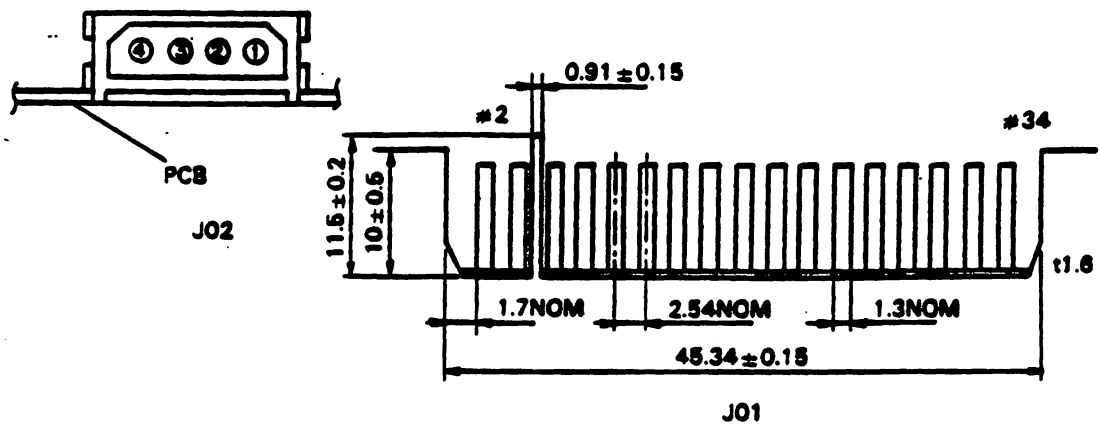


Fig. 9 Connector Pin Arrangement

### (3) Interface Circuit (for signals)

The interface circuit and the input/output signal levels are specified in Fig. 11 and Table 8.

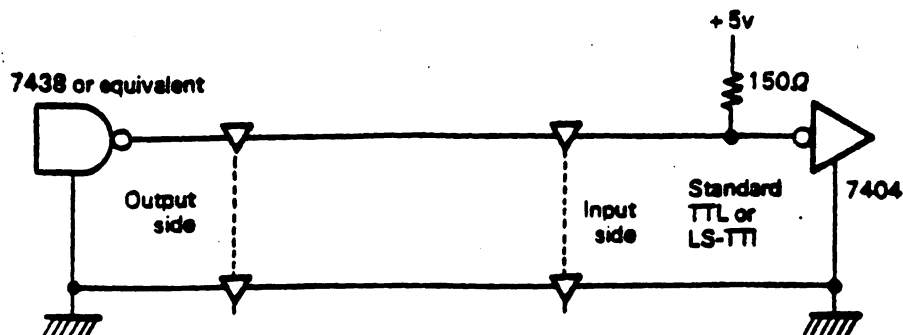


Fig. 11 Interface circuit

Table 8 Input/Output Signal Level

|               |                    |   |
|---------------|--------------------|---|
| Input signal  | High-level voltage | 2.4 ~ 5.25V (Output side: Open collector<br>$I_{OH} = 250\mu A$ max.) |
|               | Low-level voltage  | 0 ~ 0.4V  |
|               | Input impedance    | Pull up to 5V with $150\Omega$ .                                      |
| Output signal | High level         | Open collector output $I_{OH} = 250\mu A$ max.                        |
|               | Low level          | 0 ~ 0.4V ( $I_{OL} = 40$ mA max.)                                     |

\* Input/output signals are all effective at low level.

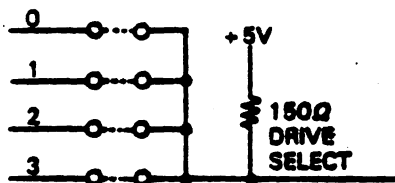
### (4) Input Signal

#### (a) DRIVE SELECT 0 ~ 3

Internal connection of the input lines is connected as shown in the figure on the below.

By shorting one of the short plug, the number of the intended drive is specified.

HFD 305D is shipped with only the 0 shorted, thus, when the DRIVE SELECT 0 signal is set at the "Low" level, drive selection can be effected for activation of a particular drive. On a system in which plural units of the drive are operated through the daisy chain connection, only one of 0 ~ 3 of the drive can be shorted.



#### (b) MOTOR ON

This input signal, when activated to a "Low" level, will turn ON the drive motor circuit.

By turning OFF ("High") this signal during a nonoperating period, motor service life can be extended.

A minimum 1sec. delay after activating this signal (MOTOR ON) is necessary before read/write, so that motor speed becomes stabilized.

### (5) Output Signal

#### (a) INDEX

Upon sensing the index hole once every rotation of the disk, an INDEX pulse is output to indicate the beginning of a track.

#### (b) TRACK 00

This signal at "Low" level indicates that the Read/Write head is positioned at track 00 (outermost track).

#### (c) WRITE PROTECT

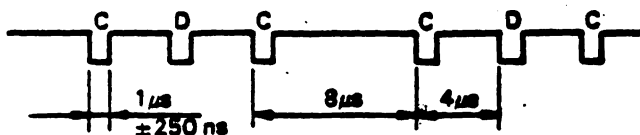
When a write protected disk is installed, this signal is at the "Low" level and the drive inhibits writing.

#### (d) READ DATA

Normally, "High" level.

When reading data, digitalized data (RAW DATA: clock and data combined) is output.

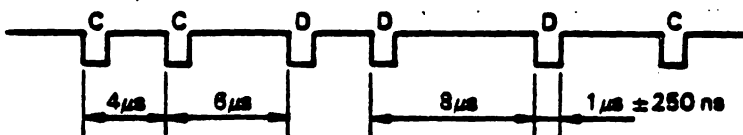
For FM record



C (clock) : Leading edge of bit pulse with respect to the reference position ...  $\pm 800$  ns max.

D (data) : Leading edge of bit pulse with respect to the reference position ...  $\pm 400$  ns max.

For MFM record



Leading edge of each bit pulse with respect to the reference position ...  $\pm 700$  ns max.

#### (e) READY

This READY signal indicates that the drive is ready for Read/Write operation. The signal becomes "Low" level when all the following conditions are satisfied:

- (i) The drive is supplied with +5V and +12V power.
- (ii) The MOTOR ON signal is "Low".
- (iii) Drive selecting has been effected.
- (iv) Index pulse is detected at a given period or below. (Motor rotational speed is about 65% or more)

### (6) Timing

Fig. 13 illustrates timing of the Interface signal for each operation.

